Review of the CPG's Memorandum

STATUS OF THE CPG'S SEDIMENT TRANSPORT MODEL

Prepared by Moffat & Nichol and Deltares

General Comments

The memo entitled "STATUS OF THE CPG'S SEDIMENT TRANSPORT MODEL" provides a helpful documentation of the development of the CPG's sediment transport model. This represents a convenient compilation of material presented in various modeling meetings, as well as new information.

In addition to the CPG' sediment transport memo, the CPG also provided model input files. Model simulations have been executed using the CPG's approach of decoupling hydrodynamic-and sediment transport modeling. Simulations using the same inputs with coupled hydrodynamics and sediment transport are nearly complete. Comments provided below are primarily based on the CPG sediment transport memo. Additional comments will be provided based on the simulation results, including comparison of the decoupled and coupled implementations.

The memo acknowledges that the understanding of sediment transport processes is more complete for the Passaic portion of the model domain than for Newark Bay, and that changes are anticipated as Sedflume data from Newark Bay are analyzed and additional understanding is developed from upcoming efforts that will be focused on Newark Bay. It is noted in this review that changes to model parameterization in Newark Bay may affect model results in the Passaic Rive in ways that will require revision to the parameterization in the Passaic River portion of the domain. The response in the Passaic over the 16+ year-long simulation may indicate the need for changes, even if comparisons between model results and data from the PWCM program are not sensitive enough to signal the need for a change in parameterization. We agree with the CPG's assessment that the model calibration is an "ongoing task".

A model input assumption that is not constrained at this point is the composition of solids inputs from the boundaries. The importance of this assignment is acknowledged in the CPG memo (pg. 32). At Dundee Dam, none of the solids inputs are assumed to be in the silt-size range. Above a certain flow threshold, a small proportion of very fine sand is included in the solids boundary inputs, and at flows below the threshold, all of the solids are assumed to be in the clay-size range. Given the different settling velocities for the silt and clay size classes specified in the model, and recent discussions of specifying different contaminant partitioning characteristics, the assumption of no silt class inputs at Dundee Dam could have significant affects on contaminant results. In addition to data analyses to assess this assumption, the effect of the assumption of the boundary solids composition can be

evaluated by comparing the composition of deposited solids to grainsize distribution data for the sediment bed and HV-CWCM LISST data for the Dundee Dam station (as well as Passaic stations) when available.

The overall characterization of the agreement between bed elevation changes computed by the model and derived from differences between bathymetry data sets is described to be in better agreement than appears on Figures 30-32 of the memo. These figures suggest a tendency in the model results to over estimate the amount of deposition. Aggregating model- and data-derived erosion and deposition over sections of the river should be performed to allow a more quantitative comparison to be developed.

Specific Comments

Section *2.3.1 Salt Front*. In subsequent documentation, more detail should be provided for the description of the low-pass filtering (e.g. time period of filter). Depending on the filter period, the effect of forcing other than river discharge may still be present. For instance, a 35- hour filter would eliminate the tidal influence but the residual forcing due to coastal setup/setdown as a result of atmospheric perturbances (i.e. storm surges) would still remain.

Section *3.2.1 Particle Size Classes and Distribution*. In subsequent documentation, a more detailed description should be provided for:

- How grainsize data from different datasets were merged
- How grainsize initial conditions for within and outside of channel were handled for cells straddling the channel-shoal boundary

Plots of data and 2-mile average initial conditions should be presented for only-within and only-outside the channel

Information should be presented for grainsize data and initial conditions for subsurface layers

Section *3.2.3 Boundary Conditions.* Chant's 2000-2002 mooring data in the Kills should be used for suspended solids boundary conditions for time periods with shallower depths in the navigation channels in the Kills and Newark Bay. Chant (2010) compared solids fluxes from NY-NJ Harbor into the Newark Bay system based on the 2000-2002 vs. 2008-2009 periods and concluded that the Harbor Deepening Project resulted in an increase in solids flux into the bay. Model inputs should reflect the lower fluxes in the earlier portion of the calibration period.

Suspended solids boundary conditions at Dundee Dam are assigned in the clay-size class at low to moderate flows, "with a small proportion of fine sand also included when flows exceed a given threshold". Available data, such as the recently collected LISST data obtained as part of the high-volume CWCM program, and Malcolm Pirnie sediment trap data, should be used to assess the reasonableness of this assignment.

Section *3.2.4 Erosion Properties.* The description of the analyses performed to derive the entrainment rate from the fluff layer of the bed provides a high level explanation of overall process. A much more

detailed description, which would be out of balance with the remainder of the document, would be required to completely present the details pieces, such as the method for accounting for travel time, decision on which data to include and exclude, and method for spatially averaging shear stress, etc. It would be more efficient to schedule a detailed technical discussion to go through these specific details of the analysis.

Figure 11 presents a comparison of critical shear stresses computed from a power-law fit of the erosion rate data to critical shear stress calculated from the average of the highest shear stress which did not cause erosion and the next higher shear stress which did cause erosion. This figure should be expanded to show the same information by specific depth intervals into the sediment.

Section *3.3.1 Schematization of Bed Layering* Justification is needed for the decision to base the skin friction calculation (as a fraction of total bed shear stress) on the initial D_{50} of the bed. If the D_{50} changes substantially over time, this assumption could have a significant affect on the results. The evolution of the grainsize distribution of the bed through the course of the simulation should be presented.

Section *4.3.1 Suspended Solids Concentrations, Fall 2009 PWCM*. Boundary conditions assigned at Dundee Dam during the period of the fall PWCM program were not based on the PWCM data, but were based on the rating curve used for periods when data are not available. This is cited as a potential explanation of the general high bias of computed suspended solids at RM 13.5, compared to PWCM data. It is assumed and expected that the PWCM data from above Dundee Dam will be incorporated into boundary conditions as the modeling effort progresses.

Section *4.4. Model Validation: Simulation of Historical Infilling* The approximate nature and uncertainty in inputs for this test of the model are appropriately acknowledged. The test should:

- Use open boundary solids inputs from Chant's 2000-2002 deployments, which would likely be closer to historical inputs that boundary conditions based on post-harbor deepening
- Calculate data-based sedimentation between 1949 and the next available bathymetry survey, to better approximate the historical period
- Show results for Newark Bay as a check that model behavior in the bay is not distorting the response in the LPR
- Evaluate the composition of solids accumulations compared to data

Additional Minor Points

In section 1.0, the CPG model framework is described as "identical to the one used by Region 2…". Given the CPG's replacement of the original active layer with a fluff layer and transition layer, the CPG framework should be described as a modified version of the one used by Region 2.

EPA Region 2 requested the memo describing the CPG's sediment transport model in an email on September 6, 2012 (S. Vaughn to R. Law), not during the September 25, 2012 model collaboration meeting, as stated in section 1.0